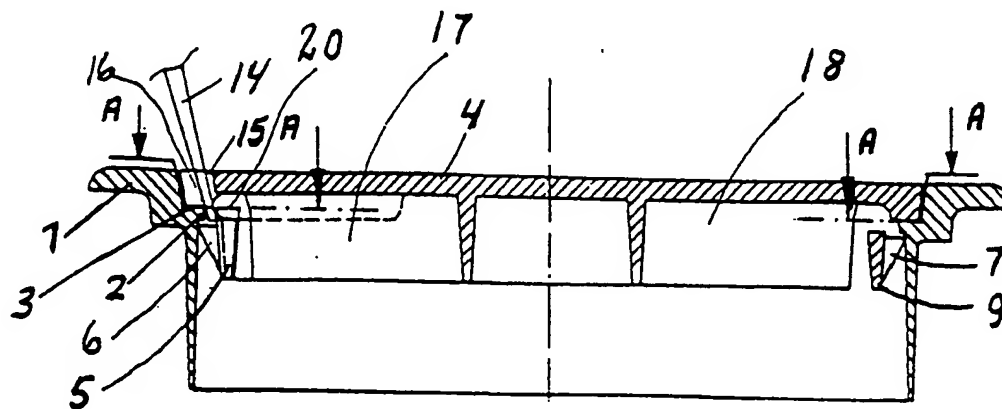


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>4</sup> :  E02D 29/14	A1	(11) International Publication Number: WO 86/ 04624  (43) International Publication Date: 14 August 1986 (14.08.86)
(21) International Application Number: PCT/NO86/00008 (22) International Filing Date: 29 January 1986 (29.01.86) (31) Priority Application Number: 850359 (32) Priority Date: 30 January 1985 (30.01.85) (33) Priority Country: NO  (71) Applicant: FURNES JERNSTÖPERI AS [NO/NO]; P.O. Box 10, N-2310 Stange (NO). (72) Inventor: REFSAHL, Johan ; Refsahl Nordre, N-2332 Åsvang (NO). (74) Agent: TANDBERGS PATENTKONTOR A-S; P.O. Box 7085H, N-0306 Oslo 3 (NO).		(81) Designated States: DE, DK, FI, GB, SE.  Published <i>With international search report.</i>

(54) Title: SELF-LOCKING MANHOLE COVER



## (57) Abstract

A self-locking manhole cover (4) has stiffening ribs (8, 10, 17, 18) secured to its underside and a locking means (6) on its underside, the locking means (6) being intended to engage beneath the flange (2) of a manhole frame (1) when the cover has been placed in the manhole frame. By action against an elastic force which keeps the locking means (6) beneath the flange (2), the locking means (6) may be released from the locking position by operating a tool (14) which is inserted down through a hole (15) in the manhole cover (4). The locking means (6) consists of a protruding boss which is secured to a resilient arm (5) which is secured to the underside of the cover (4) and extends parallel to its plane and essentially parallel to part of the periphery of the cover (4) and near thereto. The cover (4) is on its underside further provided with at least one further locking means (7) intended to engage beneath the flange (2) of the manhole frame (1) when the cover has been positioned in the manhole frame.

***FOR THE PURPOSES OF INFORMATION ONLY***

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GA	Gabon	MR	Mauritania
AU	Australia	GB	United Kingdom	MW	Malawi
BB	Barbados	HU	Hungary	NL	Netherlands
BE	Belgium	IT	Italy	NO	Norway
BG	Bulgaria	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	LI	Liechtenstein	SN	Senegal
CH	Switzerland	LK	Sri Lanka	SU	Soviet Union
CM	Cameroon	LU	Luxembourg	TD	Chad
DE	Germany, Federal Republic of	MC	Monaco	TG	Togo
DK	Denmark	MG	Madagascar	US	United States of America
FI	Finland	ML	Mali		
FR	France				

Self-locking manhole coverThe technical field

5 The invention relates to a manhole cover of the self-locking type which can only be removed from the manhole ring by loosening the cover therefrom using a suitable tool therefor. The invention relates to both large and small manhole covers which are automatically locked when placed in the manhole ring, and by manholes  
10 not only conventional municipal manholes for inspection of laid pipes, in particular sewage pipes and water pipes, are to be understood, but any type of manhole, like e.g. septic tanks and wells.

15 The prior art

Large manhole covers are mainly formed of cast iron and are themselves so heavy that the weight alone usually prevents them from being opened by unauthorized persons or from being tipped or sucked up by large cars or  
20 cleaning machines passing over the covers.

For small manhole covers it is also known to increase their weight by using concrete weights for thereby making it heavy to open the cover. If suitable tools, like crowbars or iron rods etc., are used, heavy covers may, nevertheless,  
25 be moved or bent up by unauthorized persons. In order to prevent this methods are known which are directed to locking the cover by means of chains. Swiss Patent No. 448917 and Norwegian Patent No. 145927 show use of chains as locking means for manhole covers. It is also known to use specially  
30 made tools in order to remove covers from manholes. Thus, in Swiss Patent No. 565906 and in West-German published patent application No. 2713595 lifting hooks are disclosed which are adapted to lifting holes in covers in order to be able to lift or move these.

35 In Swedish accepted specification No. 436050 a manhole cover has been shown and disclosed having a cross of four stiffening flanges or ribs attached to the under-side of the cover, each stiffening flange extending

radially from the middle of the underside of the cover towards the periphery of the cover. At one of its ends one of the stiffening flanges is provided with a hook boss which is in engagement beneath a flange formed on a manhole ring (manhole frame) against which the cover rests. At 5 the essentially diametrically opposite side of the hook boss the cover has a hook at its periphery for engagement beneath a resilient rod which is arranged along a chord in the manhole ring and which at its ends is secured in the ring. Through an aperture in the cover arranged above the 10 resilient rod a tool may be introduced and bend the rod backward so that the hook becomes released of its engagement beneath the resilient rod.

In British patent application 2085946 a manhole cover 15 is shown and disclosed which can be locked in a supporting frame by means of a resilient bendable strip which at one of its ends is anchored to the underside of the cover and which has a free end which protrudes through a wide slot into a recess of the frame, whereby the free end of the 20 strip becomes locked in the frame. The strip may be released from its locking position by introducing a key through a hole in the surface of the cover so that the key will engage the strip on the underside of the cover. Turning the key, the strip will be bent in a plane parallel to 25 the plane of the cover, whereby the free end of the strip will be released from the recess in the frame as the free end influenced by the key is bent to the side in a plane parallel to the underside of the cover and towards the other end of the slot, whereupon the cover can be lifted 30 up.

The covers and the associated locking systems disclosed in Swedish accepted specification 436050 and in British patent application 2085946 will function as intended only if the cover is placed in certain positions when 35 placing the cover in the manhole frame.

Description of the invention

By the invention it is aimed at providing an improved self-locking manhole cover which is easy to place in a manhole ring while obtaining the self-locking effect without the cover being dependent upon having to be placed in any definite position in the manhole frame, the cover being simultaneously securely assured against being opened by unauthorized persons or against being moved or sucked up by large cars or cleaning machines passing over the cover. It is a further purpose of the invention that the manhole cover may easily be opened by a person who knows how the self-locking locking means functions without the person in order to open the cover having to use a specially prepared tool.

Thus, the invention relates to a self-locking manhole cover with stiffening ribs attached to the underside of the cover and with a locking means intended to engage under the flange of a manhole frame when placing the cover in the manhole frame, and which upon influencing against an elastic force which keeps the locking means beneath the flange can be released from the locking position by using a tool which is inserted down through a hole in the manhole cover. That which is characteristic of the self-locking manhole cover according to the invention is that the locking means consists of a protruding boss which is secured to a resilient arm which is secured to the underside of the cover and extends essentially parallel to the plane of the cover and in the locking position extends essentially parallel to part of the periphery of the cover and close thereto, and the cover at its underside being provided with at least one further locking means designed to engage under the flange of the manhole frame.

Brief description of the drawings

On the drawings

Fig. 1 shows a vertical section through a cover according to the invention and associated manhole frame system, with the cover having been placed in position on the internal

receiving face of the manhole frame,

Fig. 2 shows the cover and the manhole frame system shown in section in Fig. 1, in the form of a section taken in accordance with the arrows A-A according to Fig. 1,

5 Fig. 3 shows the same section as has been shown in Fig. 1, however, with another auxiliary locking means on the underside of the cover,

10 Fig. 4 shows the cover with the manhole frame system shown in section in Fig. 3, in the form of a section taken in accordance with the arrows A-A according to Fig. 3,

Fig. 5 shows the same section as has been shown in Fig. 1, however, with another auxiliary locking means on the underside of the cover, and

15 Fig. 6 shows the cover and the manhole frame system shown in section in Fig. 5, in the form of a section taken in accordance with the arrows A-A according to Fig. 5.

#### The best embodiment

20 The cover and the manhole frame system shown in Fig. 1 comprise a frame 1 with a receiving face 3 for the cover 4, a flange or shelf 2 having been shaped immediately beneath the receiving face 3 of the frame. On its underside the cover 4 is provided with radial stiffening ribs 17, 18, and on one side of the cover this is provided with a hole 25 15. The receiving face 3 of the manhole frame inwardly ends in an edge 16. A resilient arm 5 has been secured to one of the stiffening ribs 8 (Fig. 2). The resilient arm has preferably been cast to the rib, however, it can also be secured to the rib in other ways, e.g. by threading it to 30 the rib. At its end the arm 5 has a boss 6 attached which according to the Figure has been shown in the form of a wedge-shaped body which has an upper face which upon the cover 4 having been placed in the manhole frame 1 will engage beneath the internal circular flange or shelf 2. 35 The boss 6 will then lock the cover 4 securely beneath the shelf 2 and prevent the cover 4 from being lifted up on this side. In order to lock the cover 4 on the opposite side a similar boss 7 has been arranged which is secured

to a resilient arm 9 which in its turn is secured,  
preferably cast, to a stiffening rib 10 (Fig. 2). The  
engagement face of the boss 7 will similarly engage  
beneath the internal circular shelf 2 when the cover has  
6 been placed in the manhole frame 1. Thereby the cover 4  
will be locked in two positions around its periphery and  
be well secured against being unintentionally tipped up  
from the manhole frame. Due to this double locking of the  
manhole cover against unintentional tilting up it is also  
10 possible to make the cover lighter than what would else  
have been the case, and the cover may then more easily be  
handled but simultaneously be securely assured against  
being opened by unauthorized persons or against being  
tipped or sucked up by large vehicles or cleaning machines  
15 which pass over the cover.

When the cover 4 is to be released from its locked  
position in the manhole frame 1 a rigid long member 14,  
e.g. a crowbar, is inserted into the hole 15 so that the  
accute end of the crowbar will engage between the internal  
20 edge 16 of the receiving face 3 and the resilient arm 5.  
By bending the crowbar 14 against the edge 16 the  
resilient arm 5 will be pressed inwardly so that the boss  
6 will be pulled out from its locking position beneath the  
shelf 2. A further tilting movement of the crowbar 14  
25 which rests against the edge 16 will release the cover 4  
from the frame 1 at the side of the cover where the  
crowbar hole 15 is, and the cover 4 can be lifted out from  
the frame.

In Fig. 2 besides those parts of the cover and the  
30 frame system which have been shown in Fig. 1 which  
represents a section taken in accordance with the section  
line B-B according to Fig. 2, a stiffening rib 10 is  
shown to which the resilient arm 9 with the boss 7 secured  
to the arm 9 has been attached, preferably cast. Further,  
35 the stiffening rib 8 has been shown to which the resilient  
arm 5 with the boss 6 secured thereto has been attached,  
preferably cast. The upper profile of the crowbar hole 15  
has been shown by means of reference numeral 19.

In Fig. 3 and Fig. 4 the left halves of the figures are identical to the left halves of Fig. 1 and Fig. 2 respectively. However, instead of the locking boss 7 and the resilient arm 9 according to Fig. 1 and Fig. 2 a locking boss 11 is secured to a stiffening rib 12 as a radial extension thereof. It appears that the boss 11 also has an upper engagement face which will engage against the receiving face of the flange or the shelf 2 when the cover 4 has been placed in the manhole frame 1.

The left halves of Fig. 5 and Fig. 6 are essentially identical to the left halves of Fig. 1 and Fig. 2 respectively. However, instead of the auxiliary locking means 7, 9, 10 according to Fig. 1 and Fig. 2 and instead of the auxiliary locking means 11, 12 according to Fig. 3 and Fig. 4 another auxiliary locking means 13 has been shown in Fig. 5 and Fig. 6. This consists of a circular rib which has been cast to the underside of the cover 4 and goes clear of the internal flange or shelf 2 when the cover is placed in the manhole frame. It appears that the rib 13 protrudes further down below the cover 4 than the stiffening ribs 17, 18 per se. The rib 13 must be so high that the cover 4 may not unintentionally be tipped out of the manhole frame 1.

When placing the cover 4 according to Fig. 1 in the frame 1 the cover may be laid down in an arbitrary manner because the locking bosses 6 and 7 sit on the resilient arms 5 and 9 respectively and will be pushed in by the weight of the cover when placing this in the frame 1.

When laying down the cover 4 according to Fig. 3 and Fig. 5 care must only be taken that the cover 4 firstly be placed in the frame 1 with that side at which the boss 11 respectively the rib 13 sits. The locking boss 6 will then automatically come on the underside of the flange or the shelf 2 because the locking boss 6 sits on the resilient arm 5 which will flex inwardly when the cover 4 is pushed down into the frame 1.

The self-locking covers according to the invention are simple to produce. When casting the cover 4 the



resilient arm 5 may simultaneously be cast at the underside of the cover. According to the embodiment of the cover shown in Fig. 1 and Fig. 2 also the resilient arm 9 may be cast at the underside of the cover simultaneously with the casting of the cover. However, the boss 7 with the resilient arm 9, and the boss 11 (Fig. 3 and Fig. 4) may also be secured to the cover 4 in another manner than disclosed, e.g. by threading.

Irrespective of whether the resilient arms 5, 9 are cast simultaneously with the cover or independently of the cover, the function thereof will be the same after they have been secured to the underside of the cover 4 along with the bosses 6 and 7 respectively.

However, it is preferred when casting the cover 4 to simultaneously cast the locking means disclosed at the underside of the cover. Thereby a very rational production of the cover with the locking means will be obtained.

The internal flange or shelf 2 is also formed when casting the manhole frame and does not require any later working.

The materials of which the cover according to the invention with locking means are made can be cast iron, however, not conventional grey cast iron because this would be too little flexible to enable the arms 5, 9 to flex inwardly. Accordingly, a more ductile cast iron must be used, and preferably spheroidal graphite iron is used. Because spheroidal graphite iron is also stronger than conventional grey cast iron, the weight of the cover may be correspondingly reduced while obtaining the same strength for the cover as when using the greater weight of grey cast iron. Moreover, due to the secure locking of the cover in the manhole frame the weight of the cover is not decisive for whether the cover will stay securely in place. For this reason the cover may also be made of more light, but strong, materials, and suitable materials for the cover are glass fiber or carbon fiber reinforced plastics.

In the Figures it has been indicated by means of reference numeral 20 that the resilient arm 5 under the

hole or the notch 15 through the cover is provided with a raised portion. This has been done in order to make it easier for the bending tool 14 to catch the arm 5 when inserting the tool down into the hole or the notch 15.

5 Further, it is advantageous that the arm 5 below the raised portion 20 be provided with a small notch at its face which is facing the shelf 2 so that the tool 14 when inserted into the notch or the hole 15 may more easily be engaged between the inner edge 16 of the receiving  
10 surface 3 and the arm 5.

The embodiment of the auxiliary locking means, i.e. the rib 13, shown in Fig. 5 and Fig. 6 indicates that the rib 13 extends along and a distance inwardly from the periphery of the cover 4 across an angle of  $240^{\circ}$ . This has  
15 been made in order to also well secure the cover against unintentional tipping up along a larger portion of the periphery of the cover. The height per se of the rib 13 beneath the cover 4 is to be such that when attempt is made to tilt the cover, the rib will abut the dependent  
20 skirt of the frame 1 or beneath the shelf 2. Of course, the angle of the periphery of the cover across which the rib 13 spans may vary because the main purpose with the rib 13 is to ensure locking of the cover at the diametrically opposite side of the cover in relation to the locking boss 6.

25 Even though the cover according to the invention has been disclosed and illustrated in the form of a circular cover, it is clear that the cover may also be quadrangular, i.e. rectangular or square, and rest in a corresponding rectangular or square frame 1. The former then only has  
30 to be provided with the shelf 2 along the sides which corresponds to those sides of the cover 4 where the locking means 6 and 7, 11 and 13 respectively are positioned. However, for a square cover the manhole frame is to be provided with a shelf 2 along all sides so that the cover  
35 may be placed in the manhole frame irrespective of at which side of the cover on its underside the locking means are positioned.

C l a i m s

1. Self-locking manhole cover (4) with stiffening ribs (8,10,12) secured to the underside of the cover and a locking means (6) intended to engage beneath a flange (2) of a manhole frame (1) and which by action against an elastic force which keeps the locking means (6) beneath the flange (2) may be released from the locking position by operating a tool (14) which is inserted down through a hole (15) in the manhole cover (4), characterized in that the locking means (6) consists of a protruding boss which has been secured to a resilient arm (5) which is secured to the underside of the cover (4) and extends parallel to its plane and in locking position extends essentially parallel to part of the periphery of the cover (4) and close thereto, and the cover (4) being provided on its underside with at least one further locking means (7,11,13) which is intended to engage beneath the flange (2) of the manhole frame (1).
2. Manhole cover according to claim 1, characterized in that the resilient arm (5) is secured to one (8) of the stiffening ribs, preferably by being cast to the rib (8).
3. Manhole cover according to claim 1 or 2, characterized in that besides the locking boss (6) which is secured to the resilient arm (5) it has a further locking means consisting of a protruding boss (7) which is secured to a resilient arm (9) which extends parallel to the plane of the cover (4) on its underside and in locking position extends essentially parallel to part of the periphery of the cover (4) and is secured to the underside of the cover by being secured, preferably cast, to one (10) of the stiffening ribs.
4. Manhole cover according to claim 1 or 2, characterized in that besides the locking boss (6) which is

secured to the resilient arm (5) it has a further locking means consisting of a boss (11) which is secured to the end of one (12) of the stiffening ribs and form an outward extension thereof.

5  
10  
15  
5. Manhole cover according to claim 1 or 2, characterized in that besides the locking boss (6) which is secured to the resilient arm (5) it has a further locking means consisting of a rib (13) which is secured to the underside of the cover (4) near its periphery and extends parallel to part of the periphery of the cover and extends sufficiently down below the cover so that upon attempt to tilt the cover (4) out of the manhole frame (1) it will abut against the dependent skirt of the manhole frame beneath the flange (2) of the manhole frame (1).

20  
6. Manhole cover according to anyone of claims 1 to 4, characterized in that the locking means (6,7; 6,11) are arranged substantially on opposite sides of the manhole cover (4) on the underside thereof.

25  
7. Manhole cover according to anyone of claims 1 to 6 having circular shape, characterized in that the stiffening ribs (8,10;8,11;8,18) extend radially outwardly towards the periphery of the cover (4).

30  
8. Manhole cover as claimed in anyone of claims 1 to 7, characterized in that the bosses (6,7,11) are wedge shaped having an outwardly facing surface which runs obliquely downward and inward towards the lower edge of the resilient arm (5,9) respectively the stiffening rib (12) to which they are secured.

35

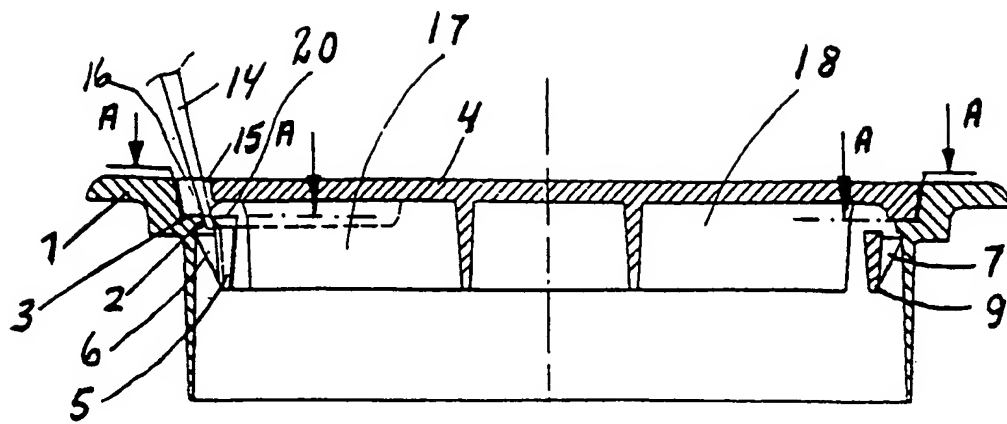


Fig. 1

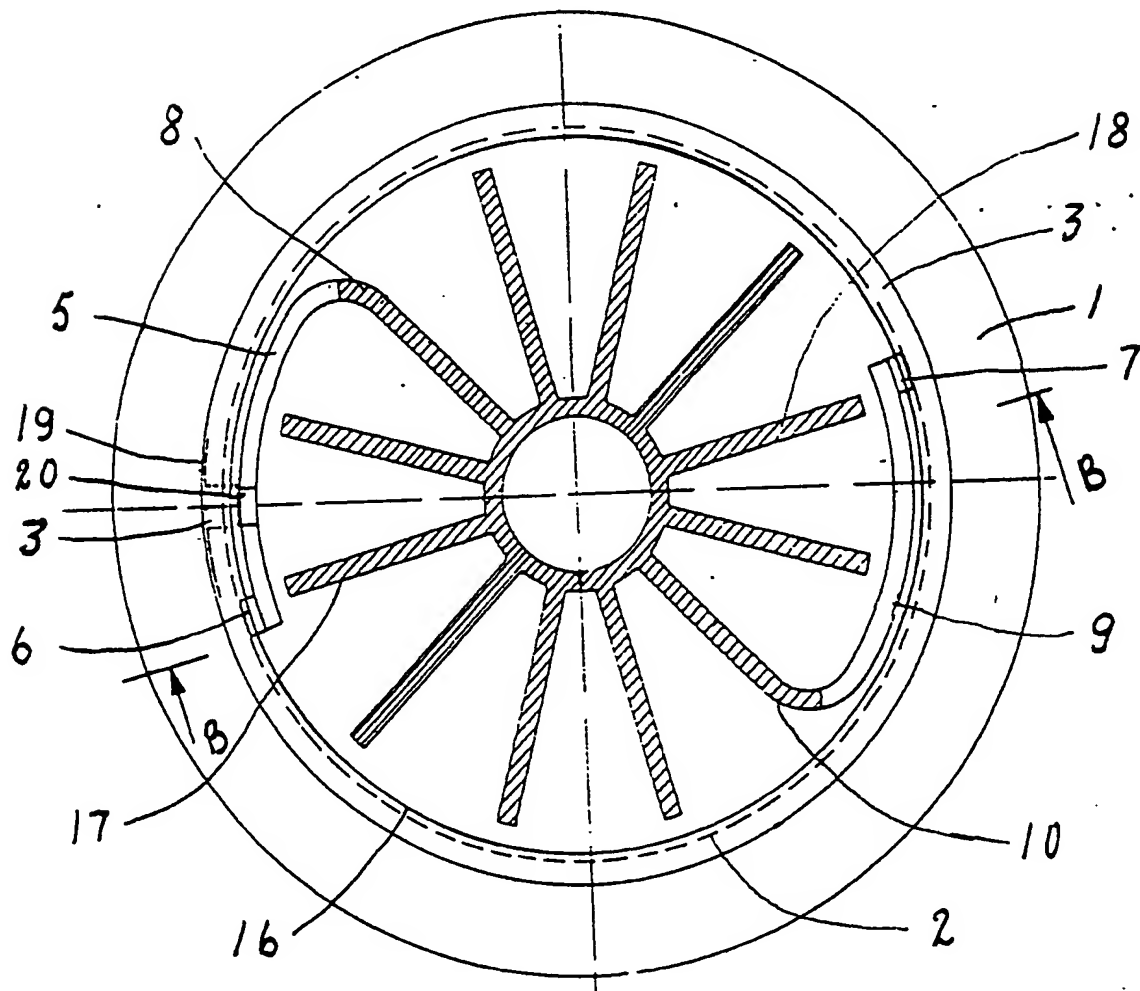


Fig. 2

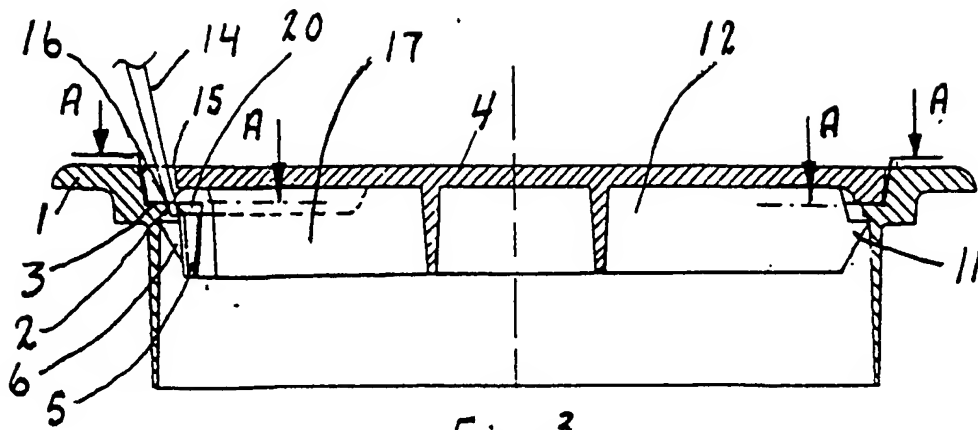


Fig. 3

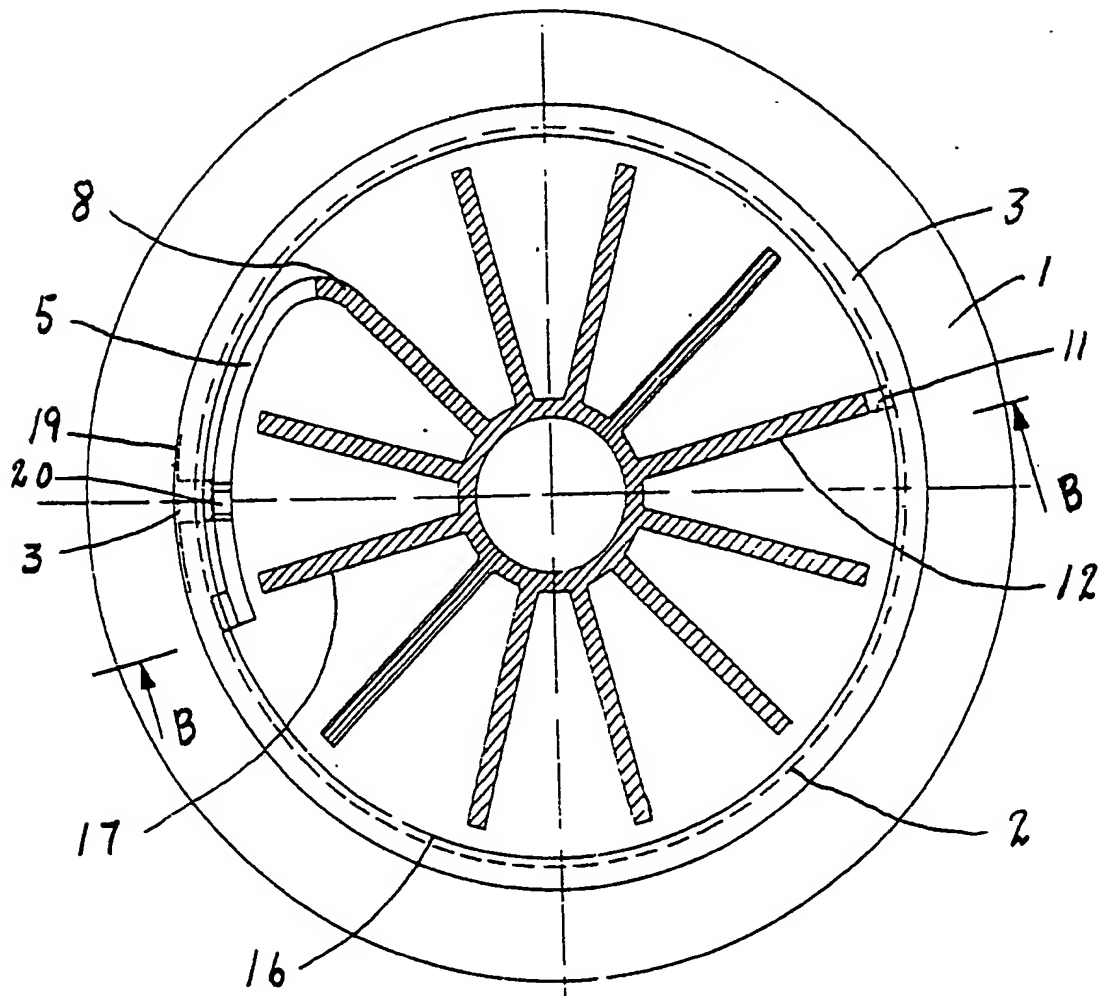


Fig. 4

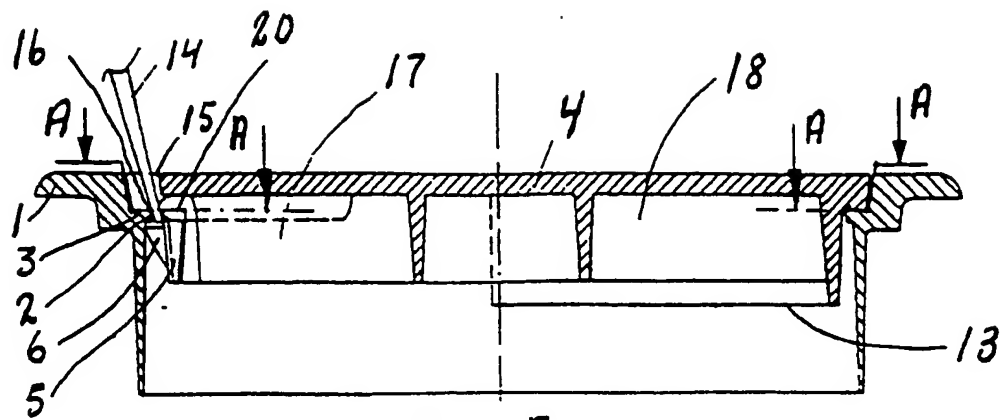


Fig. 5

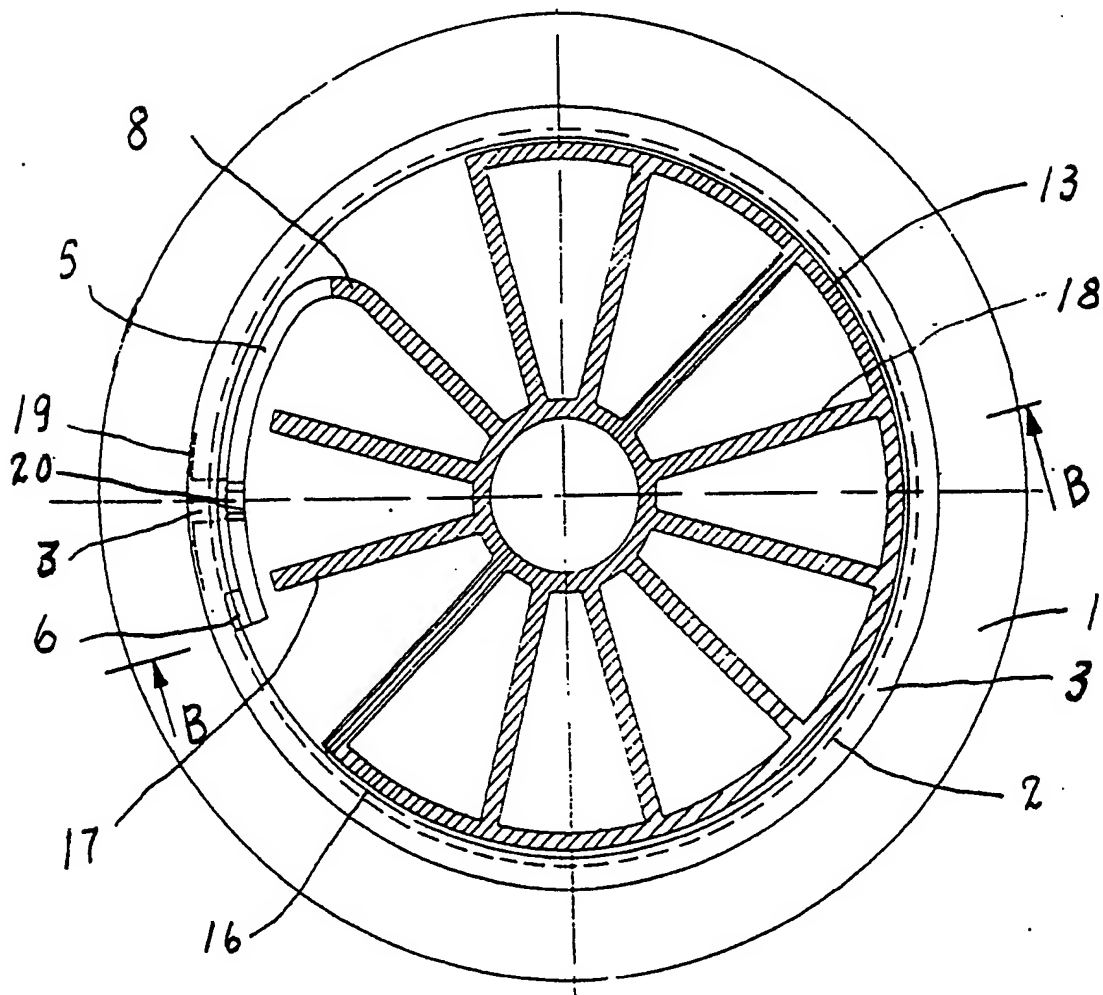
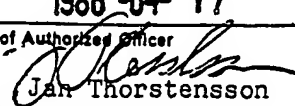


Fig. 6

# INTERNATIONAL SEARCH REPORT

International Application No PCT/NO86/00008

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC <span style="float: right;">4</span>		
E 02 D 29/14		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC 4 US C1	E 02 D 29/12, /14; E 03 F 5/02 404: 25, 26	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
SE, NO, DK, FI classes as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with Indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	SE, B, 416 483 (VARNÄSFÖRETAGEN AB) 5 January 1981	
A	SE, B, 436 050 (UPONOR AB) 5 November 1984	
A	GB, A, 2 085 946 (BRITISH STEEL CORP.) 6 May 1982	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1986-04-15	1986-04-17	
International Searching Authority	Signature of Authorized Officer	
Swedish Patent Office	 Jan Thorstensson	